Worked Examples using R, *Introductory Statistics, 7th ed.* by Neil Weiss

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Contents

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Abstract

This paper consists of the worked examples in each chapter of *Introductory Statistics, 7th Edition* by Neil Weiss, using the R programming language

1 Chapter 1

1.1 Example 1.1, Descriptive Statistics

This example contains no code.

1.2 Example 1.2, Inferential Statistics

This example contains no code.

1.3 Example 1.3, Classifying Statistical Studies

This example contains no code.

1.4 Example 1.4, Classifying Statistical Studies

This example contains no code.

1.5 Example 1.5, Simple Random Samples

```r
#create vector of officials
library(prob)
off <- c('G', 'L', 'S', 'A', 'T')
#part a, list of samples of size 2
urnsamples(off, 2)
```

```
##    X1 X2
## 1   G  L
## 2   G  S
## 3   G  A
## 4   G  T
## 5   L  S
## 6   L  A
## 7   L  T
## 8   S  A
## 9   S  T
## 10  A  T
```

```
#part d, list of samples of size 4
urnsamples(off, 4)
```

```
##   X1 X2 X3 X4
## 1  G  L  S  A
## 2  G  L  S  T
## 3  G  L  A  T
## 4  G  S  A  T
## 5  L  S  A  T
```

1.6 Example 1.6, Random-Number Tables

```
#generate 15 random integers between 1 and 728
sample(1:728, 15)
```

```
##  [1] 681 594 215  14 549 107 120 587 511 491 632 162 218 421  10
```

1.7 Example 1.7, Systematic Random Sampling

```
#declare variables
pop <- 728
sos <- 15
division <- floor(pop / sos)
division
```

```
## [1] 48
```

```
start <- sample(1:division, 1)
start
```

```
## [1] 43
```

```
#generate sequence
s <- seq(start, pop, division)
s
```

```
##  [1]  43  91 139 187 235 283 331 379 427 475 523 571 619 667 715
```

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2.1 Example 2.1, Variables and Data

This example contains no code.

2.2 Example 2.2, Variables and Data

This example contains no code.

2.3 Example 2.3, Variables and Data

This example contains no code.

2.4 Example 2.4, Variables and Data

This example contains no code.

2.5 Example 2.5, Grouping Quantitative Data

```
#read in the data
invest <- read.csv("data/Tb02-01.txt")
str(invest)
```

```
## 'data.frame': 40 obs. of  1 variable:
##  $ DAYS: int  70 64 99 55 64 89 87 65 62 38 ...
```

```
w <- cut(invest$DAYS, c(30, 40, 50, 60, 70, 80, 90, 100), right = FALSE)
invest$CAT <- w
table(invest$CAT)
```

```
##
##  [30,40)  [40,50)  [50,60)  [60,70)  [70,80)  [80,90) [90,100)
##        3        1        8       10        7        7        4
```

```
x <- table(invest$CAT)
y <- prop.table(x)
z <-  merge(x, y, by.x = "Var1", by.y = "Var1")
z
```

```
##        Var1 Freq.x Freq.y
## 1  [30,40)      3  0.075
## 2  [40,50)      1  0.025
## 3  [50,60)      8  0.200
## 4  [60,70)     10  0.250
## 5  [70,80)      7  0.175
## 6  [80,90)      7  0.175
## 7 [90,100)      4  0.100
```

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6.13 Example 6.13, Using Technology to Obtain Normal Percentiles

```r
mu <- 100
sigma <- 16
ptile <- qnorm(0.90, mu, sigma)
ptile
```

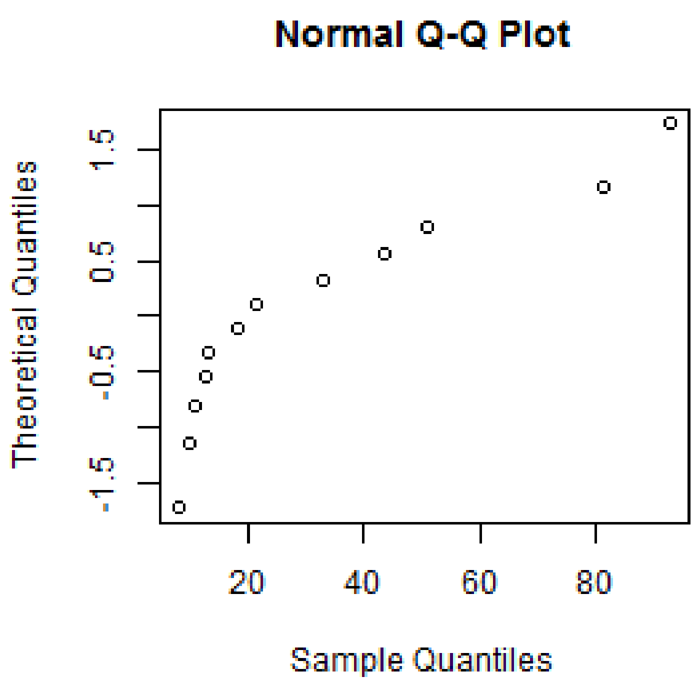
```
## [1] 120.5
```

6.14 Example 6.14, Normal Probability Plots

```r
#read in the data
income <- read.csv("data/Tb06-03.txt")
str(income)
```

```
## 'data.frame': 12 obs. of  1 variable:
##  $ AGI: num  9.7 93.1 33 21.2 81.4 51.1 43.5 10.6 12.8 7.8 ...
```

```r
qqnorm(income$AGI, datax = TRUE)
```



7 Chapter 7

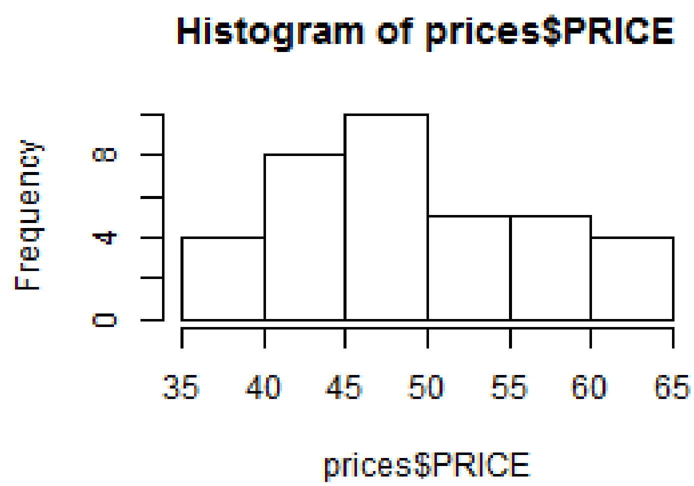
8 Chapter 8, Confidence Intervals for One Population Mean

8.1 Example 8.1, Estimating a Population Mean

```
#read in the data
prices <- read.csv("data/Tb08-01.txt")
str(prices)

## 'data.frame': 36 obs. of  1 variable:
##  $ PRICE: num  53.8 54.4 45.2 42.9 49.9 48.2 41.6 58.9 48.6 53.1 ...

hist(prices$PRICE, breaks = 5)
```




```
sum <- sum(prices$PRICE)
n <- nrow(prices)
mu <- sum / n
#alternatively
mu1 <- mean(prices$PRICE)
```

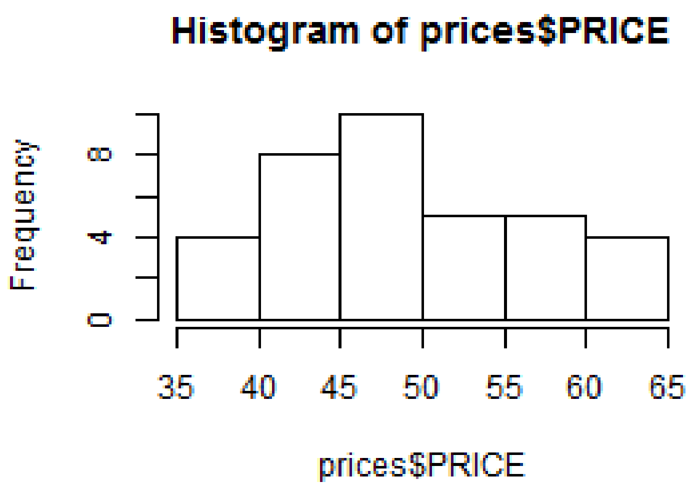
The estimated population, μ, from the sample mean, $\bar{x}$, is 49.2778.

8.2 Example 8.2, Introducing Confidence Intervals

```r
#read in the data
prices <- read.csv("data/Tb08-01.txt")
str(prices)
```

```
## 'data.frame': 36 obs. of  1 variable:
##  $ PRICE: num  53.8 54.4 45.2 42.9 49.9 48.2 41.6 58.9 48.6 53.1 ...
```

```r
hist(prices$PRICE, breaks = 5)
```




```r
sum <- sum(prices$PRICE)
n <- nrow(prices)
mu <- sum / n
sigma <- 7.2
s <- sigma / sqrt(n)
cat(sum, n, mu, sigma, s)
```

```
## 1774 36 49.28 7.2 1.2
```

```r
confidence.interval <- simple.z.test(prices$PRICE, sigma, conf.level = 0.9544)
confidence.interval
```

```
## [1] 46.88 51.68
```

8.3 Example 8.3, Interpreting Confidence Intervals

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9 Chapter 9, Hypothesis Tests for One Population Mean

9.1 Example 9.1, Choosing the Null and Alternative Hypotheses

This example contains no code.

9.2 Example 9.2, Choosing the Null and Alternative Hypotheses

This example contains no code.

9.3 Example 9.3, Choosing the Null and Alternative Hypotheses

This example contains no code.

9.4 Example 9.4, The Logic of Hypothesis Testing

Null hypothesis is $H_0 : \mu = 454$.
Alternative hypothesis is $H_\alpha : \mu \neq 454$.

```
# load the data file
weights <- read.csv("data/Tb09-01.txt")
str(weights)

## 'data.frame': 25 obs. of  1 variable:
##  $ WEIGHT: int  465 456 438 454 447 449 442 449 446 447 ...

#declare and initialize variables
mu <- 454
sigma <- 7.8
n <- 25
xbar <- mean(weights$WEIGHT)
ztest <- (xbar - mu) / (sigma / sqrt(n))
ztest

## [1] -2.564

#determine the result of the test
result <- pnorm(ztest)
result

## [1] 0.005172
```

```
#use simple z test from UsingR package
library(UsingR)
conf.int <- simple.z.test(weights$WEIGHT, sigma = sigma, conf.level = 0.9544)
conf.int

## [1] 446.9 453.1
```

The claimed weight of the population is μ per bag, 454 grams. The mean sample weight is $\bar{x}$ per bag, 450 grams. The z value is -2.5641, which is more than two standard deviations below the population mean.

9.5 Example 9.5, Type I and Type II Errors

This example contains no code.

9.6 Example 9.6, Obtaining the Critical Values

```
left.tail <- qnorm(0.05)
left.tail

## [1] -1.645

right.tail <- qnorm(0.95)
right.tail

## [1] 1.645

two.tail.left <- qnorm(0.025)
two.tail.left

## [1] -1.96

two.tail.right <- qnorm(0.975)
two.tail.right

## [1] 1.96
```

9.7 Example 9.7, The One-Sample z-Test

Null hypothesis is $H_0 : \mu = \$51.46$.
Alternative hypothesis is $H_\alpha :> \$51.46$

```
# load the data file
books <- read.csv("data/Tb09-05.txt")
str(books)

## 'data.frame': 40 obs. of  1 variable:
##  $ PRICE: num  56 46.2 47.3 54 53.7 ...

#declare and initialize variables
mu <- 51.46
sigma <- 7.61
```

```
n <- 40
xbar <- mean(books$PRICE)
right.tail = 0.01
ztest <- (xbar - mu) / (sigma / sqrt(n))
ztest

## [1] 2.851

right.crit <- qnorm(1 - right.tail)
right.crit

## [1] 2.326
```

The z statistic is 2.8508, which is greater than the critical value of 2.3263, so we reject the null hypothesis.

9.8 Example 9.8, The One-Sample z-Test

Null hypothesis is $H_0 : \mu = 800$.
Alternative hypothesis is $H_\alpha :< 800$

```
# load the data file
rda <- read.csv("data/Tb09-06.txt")
str(rda)

## 'data.frame': 18 obs. of  1 variable:
##  $ CALCI: int  686 433 743 647 734 641 993 620 574 634 ...

#declare and initialize variables
mu <- 800
sigma <- 188
n <- 18
xbar <- mean(rda$CALCI)
left.tail = 0.05
ztest <- (xbar - mu) / (sigma / sqrt(n))
ztest

## [1] -1.187

left.crit <- qnorm(left.tail)
left.crit

## [1] -1.645
```

The z statistic is -1.1873, which is less than the critical value of -1.6449, so we do not reject the null hypothesis.

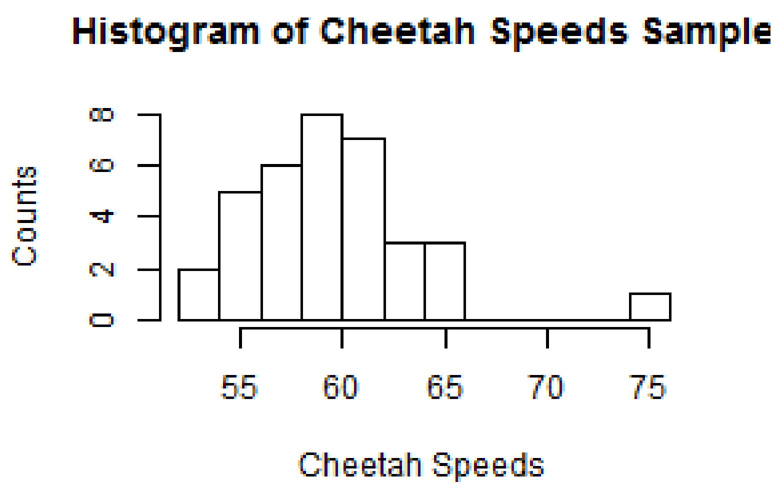
9.9 Example 9.9, The One-Sample z-Test

Null hypothesis is $H_0 : \mu = 60$.
Alternative hypothesis is $H_\alpha :\neq 60$

```r
# load the data file
cheetah <- read.csv("data/Tb09-07.txt")
str(cheetah)
```

```
## 'data.frame': 35 obs. of  1 variable:
##  $ SPEEDS: num  57.3 57.5 59 56.5 61.3 57.6 59.2 65 60.1 59.7 ...
```

```r
#histogram of the data set
hist(cheetah$SPEEDS, breaks = 15, xlab = "Cheetah Speeds", ylab = "Counts", main = "Histogram of
```




```r
#declare and initialize variables
mu <- 60
sigma <- 3.2
n <- 35
xbar <- mean(cheetah$SPEEDS)
tails = 0.05
ztest <- (xbar - mu) / (sigma / sqrt(n))
ztest
```

```
## [1] -0.8768
```

```r
crits <- qnorm(c( tails / 2, (1 - tails / 2)))
crits
```

```
## [1] -1.96  1.96
```

The z statistic is -0.8768, which is less than the critical values of -1.96, 1.96, so we do not reject the null hypothesis.

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